Original Article

Prevalence of different hip sonographic types: A cross-sectional study

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Abstract

Background: Developmental dysplasia of the hip (DDH) is an anatomical abnormality, which needs early detection and treatment. Ultrasound (US) is a sensitive method to study neonatal hip joint and detection of different types of sonographic hip. This study was aimed to determine relative frequency of different types of DDH ultrasonographically.

Materials and Methods: Ultrasound examination was performed on 380 newborns to determine hip joint status according to the Graf ultrasound classification system for infant hips. In addition, hip joint status was compared based on the hip side, gender, and method of delivery.

Results: In this study, we observed three sonographic types: Ia (74%), type Ib (20%), and IIa (6%). No significant difference was found in relative frequency of different types of DDH regarding the side of the hip ($P = 0.18$). Type IIa was found significantly more in the female newborns ($P < 0.0001$) and in newborns who were born by cesarean section ($P < 0.0001$).

Conclusion: This study supports the role of US detection of different types of DDH; however, the frequency of pathologic types of hip sonography is 6%.

Key Words: Developmental dysplasia of the hip, Hip dislocation, hip dysplasia, ultrasonography

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INTRODUCTION

Developmental dysplasia of the hip (DDH) represents a variety of anatomical abnormalities, which is caused by abnormal relationship between the femoral head and the acetabulum.[1,2] Different factors such as female gender, white race, oligohydramnios, breech delivery, maternal estrogen levels, and familiarity may predispose a newborn to DDH.[3]Although the exact incidence of DDH is not well known yet, it has been estimated to be approximately 2-6:1000 live birth.[3]

It may result in hip function impairment and premature degeneration of the joint.[4] Diagnosis of DDH is possible within the first weeks of life.[5]There are many advantages in early detection and treatment of DDH, including earlier, shorter, and less-invasive treatments and better outcomes[6]; however, there is no gold standard for the diagnosis.[2]

Ultrasound (US) is a very efficient imaging modality for newborn hip examination. It is a well-tolerated and noninvasive method, and can provide an exquisite picture of the immature skeleton. Moreover, US is a

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very sensitive method to examine the hip joint space.[3] Therefore, US plays a key role in the diagnosis and management of DDH.

Many attempts have been made to clarify the need for early diagnosis of DDH by different methods of screening, including US, and their effects on the future management. Despite several reports that recommend using US for early diagnosis of different types of DDH, there is no conclusive evidence that confirms usefulness of US as a screening method for DDH.[5]

Given the necessity of further investigations to study the role of US in early detection of DDH, this study was designed to determine the relative frequency of different types of DDH ultrasonographically. According to information from a variety of hip sonographic types in our society, there is no necessity for every newborn screening is done in some communities is unknown. Purpose, we decided to determine population status of newborn screening is necessary or not necessary.

MATERIALS AND METHODS

After approval of the study by the ethics committee of Isfahan University of Medical Sciences and obtaining informed consent from parents, 380 newborns who were able to undergo an US examination entered this investigation by convenience sampling.

This cross-sectional study was performed on newborns who were born at the Beheshti and Al-Zahra hospitals, Isfahan, Iran, from March 2011 to January 2012.

Baseline characteristics of all cases, including gender, age, and the method of delivery were recorded.

Then, bilateral US scan was done by a single radiologist using a 7.5-10 MHz linear transducer, whereas patients were placed in the lateral position, and the position of the femur in the acetabulum was recorded.

Then, sonograms were classified and patients' hip status was determined according to the US classification system for infant hips proposed by Graf in terms of alpha- and beta-angles.[7]

Newborns with abnormal hip status were referred to the orthopedic clinic for further evaluation and management.

Data were analyzed using SPSS 16 software. Chi-square and independent *t* tests were used when appropriate. $P > 0.05$ were considered statistically significant.

RESULTS

The population of this study consisted of 209 (55%) male newborns and 171 (45%) female newborns.

There was no significant difference in the age between the two groups (6.55 ± 3.62 days for male vs. 6.28±4.12 days for female newborns, *P* value 0.50).

Regarding the method of delivery, 277 (73%) were born vaginally and 103 (27%) were born by cesarean section (CS).

According to the Graf US classification for the hip, patients' hip status was determined. In this study, we observed type Ia (74%), type Ib (20%), and IIa (6%).

No significant difference was found between the right and the left side regarding the relative frequency of different hip joint types [Table 1].

Among all cases, 20 (5%) patients had type IIa bilaterally. The total mean of alpha-angle was 62.23 ± 3.04 degrees, and mean of beta-angle was 51.21 ± 6.05 degrees.

Hip joint status and gender

There was a significant difference between male and female newborns in the relative frequency of different hip joint types [Table 2], and relative frequency of IIa

Table 1: Patients' hip status according to the Graf ultrasound classification

Variables	Right hip (%)	Left hip (%)	*P* value
Hip joint type			
I			
Ia	287 (75)	271 (71)	0.18
Ib	67 (18)	87 (23)	
IIa	26 (7)	22 (6)	

Data are presented as number (%). Hip joint type was determined according to the Graf classification: Type Ia: α>60°, β<55° at any age, Type Ib: α>60°, β>55° at any age, Type IIa: α: 50-59° for newborns less than 12 weeks

Table 2: Patients' hip status and gender

Variables	Male (%)	Female (%)	*P* value
Right hip joint type			
I			
Ia	176 (84)	111 (65)	<0.0001
Ib	28 (14)	39 (23)	
IIa	5 (2)	21 (12)	
Left hip joint type			
I			
Ia	156 (75)	115 (67)	0.007
Ib	48 (23)	39 (23)	
IIa	5 (2)	17 (10)	

Data are presented as number (%). Hip joint type was determined according to the Graf classification: Type Ia = α>60°, β<55° at any age. Type Ib = α>60°, β>55°at any age, Type IIa = α:50-59° for newborns less than 12 weeks

hip joint was significantly higher in female newborns on both the sides.

In addition, bilateral type IIa was significantly more prevalent among female newborns (15 cases vs. 5 cases, *P* value 0.005).

Mean of alpha-angle was significantly higher in the male newborns (62.62 ± 2.72 vs. 61.75 ± 3.34 degrees, *P* value 0.006), whereas beta-angle was significantly higher in the female cases (52.42 ± 5.98 vs. 50.21 ± 5.94 degrees, $P < 0.0001$).

Hip joint status and delivery method

Newborns who were born by CS (103 cases, 27%) revealed significantly higher relative frequency of type IIa hip joint than cases delivered vaginally (NVD) (277 cases, 73%) [Table 3].

Similarly, bilateral type IIa hip joint was found more significantly in those born by CS (14 cases vs. 6 cases, $P < 0.0001$).

In the NVD group, mean of alpha-angle was significantly higher than the CS group (62.57 ± 2.78 vs. 61.31 ± 3.50 degrees, $P < 0.0001$). Conversely, mean of beta-angle was significantly higher in the newborns delivered by CS (52.69±5.78 vs. 50.66±6.07, *P* value 0.003).

No significant difference was found between male and female newborns regarding the method of delivery (55 male vs. 48 female were born by CS, *P* value 0.39).

DISCUSSION

Early diagnosis and treatment of DDH affects the prognosis of a patient. It is well known that the hip joint can be found abnormal on US despite normal clinical examination.[8-11] Although there is still no consensus regarding the optimal method of newborn screening for DDH,[10,12,13] some previous studies reported that US screening for DDH reduces late presentations, inappropriate treatments, and need for surgical treatment.[14]Knowledge of pure population status will hip to design a screening strategy in our city or country. Screening of newborns with hip US is now present in some countries.

This study was aimed to apply US as a screening test to find out the relative frequency of different types of hip joint in newborns, and compare them according to different factors, such as hip side, gender, and delivery method.

In the present study, we found only types Ia, Ib, and IIa (immature) hip joint. Other types were not observed on US examination due to the sample size and extremely low prevalence of the other types.

The relative frequency of type I (94%) and type IIa (6%) in this study is nearly similar to the previous studies. For instance, an investigation on Indian population revealed a relative frequency of 4% and 92.5% for type I and type IIa, respectively.[15]

We found no significant difference between the right and the left hip regarding the frequency of hip joint types; however, a previous study by Harila *et al*.[16] reported more occurrence of DDH in the left side hip probably due to intrauterine position of fetus. This difference could be due to different ethnicity and sample size.

To provide a quantitative assessment of acetabular development, we measured the inclination angle of the cartilaginous and osseous components of the acetabulum by US. Similar to a study by Chen *et al*.,[17] we found that mean of alpha-angle was significantly higher in the male group, whereas the beta-angle had significantly higher mean in the female newborns, which could be due to inherent anatomical and physiological differences between genders.

In addition, similar to most of the previous studies that compared DDH prevalence between genders, we found type IIa hip joint significantly more prevalent among female newborns.[9,18-20] Female gender has been considered as a DDH risk factor. The mechanism suggested for this condition is maternal estrogen, which is released just before childbirth. It is transferred to the female infant, and produces effects similar to the maternal pelvic relaxation in the female infant.[9,21]

Table 3: Patients' hip status and the method of delivery

Variables	NVD (%)	CS (%)	*P* value
Right hip joint type			
I			
Ia	224 (81)	63 (61)	<0.0001
Ib	44 (16)	23 (22)	
IIa	9 (3)	17 (17)	
Left hip joint type			
I			
Ia	209 (76)	62 (60)	<0.0001
Ib	62 (22)	25 (24)	
IIa	6 (2)	16 (16)	

Data are presented as number(%). NVD: Normal vaginal delivery, CS: Cesarean section. Hip joint type was determined according to the Graf classification: Type Ia = α>60°, β<55° at any age. Type Ib: α>60°, β>55° at any age, Type IIa = α: 50-59° for newborns less than 12 weeks

Comparing relative frequency of DDH regarding the method of delivery demonstrated significantly higher rate of DDH in infants who were born by CS. The study performed by Dogruel *et al*.[9] did not suggest CS as a risk factor for DDH. This dissimilarity may be caused by some differences in management of pregnant women in our centers or there may be differences in our population. The rate of CS in our country is higher than that in developed countries (about 25% for this study). Therefore, more pregnancies including elective or emergency or high-risk pregnancies such as breech presentation, oligohydramnios,[11] or preterm delivery, which are considered as risk factors for DDH usually lead to CS. However, it is believed that the risk of late diagnosis of DDH is reduced by CS due to more accurate examination and medical care provided to these infants.[14]

This study results support the role of US as a complementary method for DDH clinical examination, which can help us to find out subclinical abnormalities more accurately; however, approving the role of US as a screening method needs a different study design with a greater study population. Also given that the study was conducted at the hospital in newborn babies suggests that parents will follow to form the abnormal hip.

The study was performed on first days of birth because these newborns were available; this is a shortcoming of our study, although it was not evitable. If we want to do the study during the second week after delivery, which is a standard time, some of our sample volume would be missed.

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